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54 Pharmaceutical composition containing an aliphatic aminosulphonic acid.

57 A pharmaceutical composition for treating psoriasis and similar or related ailments comprises at least one skin-compatible zwitterionic aminosulfonic acid (ZASA) of the formula



wherein R is a straight or branched chain aliphatic radical, or RN is a substituted or unsubstituted nitrogen-containing heterocycle which may have one additional hetero atom; and R' is C₂₋₄ straight or branched chain alkylene radical, together with a pharmaceutically acceptable topical carrier or base. The ZASA is also provided for use in the topical treatment of psoriasis and related skin disorders.

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TITLE MODIFIED

see front page

Pharmaceutical composition

This invention relates to a pharmaceutical composition for treating psoriasis, and to certain sulfonic acid derivatives for use in such treatment.

05 Psoriasis is a group of disfiguring and uncomfortable skin conditions for which physicians have long sought effective treatment methods. Its causes and etiology are very imperfectly understood. The term "psoriasis" as used in this specification designates not only the known five or
10 six conditions commonly so designated in medical practice, but also, for the sake of simplicity in terminology, other related skin disorders namely the ichthyoses group, the dyskeratoses group and Darriers disease.

15 The principal known compositions which have been used with greater or lesser success in the treatment of psoriasis belong to two groups: 1) coal tar products, 2) cortisone products. Group 1) compositions are variable and unpredictable in their effects, but their overall success
20 in symptom alleviation has been small. Some of them cause undesirable skin discoloration. Group 2) compositions bring striking short-term benefit to sufferers, but are attended by well known undesirable side-effects which constitute a contraindication of extended periods of
25 treatment.

It is an object of the invention to provide a pharmaceutical composition which will contribute to supplying the medical need mentioned above, and to provide certain sulfonic acid derivatives for use in treating psoriasis.

The invention accordingly provides a pharmaceutical composition for treating psoriasis which comprises at least one skin-compatible ~~zwitterionic~~ zwitterionic aminosulfonic acid (hereinafter ZASA) having the formula

$$\text{RNR}'\text{SO}_3\text{H}$$
wherein either R is a C₁₋₆ straight or branched chain aliphatic radical or the combination RN is a substituted or unsubstituted nitrogen-containing heterocyclic radical which may have one hetero-atom additional to the nitrogen atom that links said radical to R'; and R' is a C₂₋₄ straight or branched chain alkylene radical, together with a pharmaceutically acceptable topical carrier or base.

The invention also provides a zwitterionic aminosulfonic acid as set out above, for use in the topical treatment of psoriasis and related skin disorders. It provides in particular the preferred ZASA's set out below, for said use.

Preferably the ZASA has at least one pK_a value at 20°C in the range 6.0-8.3 to permit its use on human skin (i.e. the molecule exists mainly in its dipolar form in the pH range 6.0-8.3). All pK_a values quoted in this specification are at 20°C.

Preferred heterocyclic values for RN are N-piperazinyl, N-morpholinyl and N-[N'-(2-hydroxyethyl)]-piperazinyl.

A preferred aliphatic value for R is tris-(hydroxymethyl)-methyl.

Preferred values for R' are $-\text{CH}_2-\text{CH}_2-$ and $-\text{CH}_2-\text{CH}_2-\text{CH}_2-$.

Preferred ZASA's are:

05 2-(N-Morpholinyl)-ethane sulfonic acid (hereinafter MES) which has a pK_a of 6.15;

2-[N-[N'-(2-Hydroxyethyl)]-piperaziny]l]-ethane sulfonic acid (hereinafter HEPES) which has a pK_a of 7.55;

10 3-[N-[N'-(2-Hydroxyethyl)]-piperaziny]l]-propane sulfonic acid (hereinafter HEPPS);

2-[N-[tris-(Hydroxymethyl)]-methylamino]-ethane sulfonic acid;

2-(N-Piperaziny]l)-ethane sulfonic acid;

2-(N-Piperaziny]l)-propane sulfonic acid;

15 Piperazine-1,4-bis(2-ethane sulfonic acid) (hereinafter PIPES) which has a pK_a of 6.8; and

N,N-bis-(2-Hydroxyethyl)-2-aminoethane sulfonic acid (hereinafter BES) which has a pK_a of 7.15.

20 The ZASA's mentioned above are known in the chemical literature as buffers. Most of them are described among other compounds by Good, N. et al, in Biochemistry 1966, 5, 467.

Preferred ZASA's are mild and cause no skin irritation.

25 The effective proportion of the active ingredient, by weight of the composition, is in the range 0.05 to 20%, preferably 0.05 to 5%. In the most preferred compositions the effective proportion lies in the range 0.1% to 1.0%.

30 Not every compound falling within the general definition given above is preferred or suitable for use in the composition of the invention. Some few of them are contraindicated or unsuitable for one reason or another.

Reasons for unsuitability, and thus for exclusion from the present invention, include incompatibility with the chosen topical base. Substances forbidden by health or hygiene regulations are prima facie unsuitable and excluded. Known
05 carcinogens, or substances suspected on reasonable grounds of being carcinogens, are excluded. Substances which have any deleterious effect on the skin are excluded. Some of the compounds, for example, cause irritation, reddening or
10 chapping of the skin when used over a short period, or a long period, and are excluded. Others are excluded because they can dye or pigment the skin. These reservations do not, of course, apply to any of the preferred compounds.

Nevertheless the exclusion of unsuitable compounds is a matter well within the competence of a person skilled in the art. Carcinogens, for example, can be identified by
15 consulting published lists of such substances. Incompatibility with the chosen topical base is an empirical matter, to be determined by stability tests. Health and hygiene regulations can be presumed known to persons
20 skilled in pharmaceutical formulation. Any candidate compound can be tested on labelled small areas of healthy skin for undesirable effects such as skin irritation, reddening, chapping, dyeing and pigmenting. The number of unsuitable compounds, as a fraction of the number of ZASA's
25 embraced by the above description, is very small.

The topical base is selected from a wide variety of compositions formulated according to known principles for pharmaceutical purposes. Such compositions include creams,
solids, ointments, lotions and film-forming solutions among
30 others. They may be presented in boxes, jars or squeezable tubes, both collapsible and non-collapsible. The solids may be presented as sticks for rubbing on to the skin. Some of the topical bases may be presented as papers, woven or non-woven fabric pieces, or pads, all impregnated with the
35 composition.

The invention will be appreciated in greater detail from the following examples of specific embodiments thereof.

Example 1

05 A vanishing cream is made up from the following recipe:

A. <u>OIL PHASE</u>	<u>PARTS BY WEIGHT</u>
Stearic acid	13.0
Microcrystalline wax	6.5
Olive oil	3.5
10 Glyceryl monostearate (acid-stable grade)	3.5
Polyoxyethylene sorbitan monolaurate ¹	12.0
15 Silicone fluid (200-350 centistokes)	3.0

¹ The product sold under the trade name TWEEN 20.

B. <u>AQUEOUS PHASE</u>	<u>PARTS BY WEIGHT</u>
HEPES	0.2
Water (q.s. ad 100.0)	58.3

20 The ingredients of A are melted together and brought to 80°C. The ingredients of B are made into a solution, brought to 80°C, and added at that temperature to the melt, with mixing, which is then continued until the emulsified mass has cooled to 40°C. The product is suitably packed so
25 as to prevent evaporation, since it is an oil-in-water emulsion.

This cream is applied to an area of skin showing psoriatic symptoms, preferably several hours before the skin is due to be washed. The application may be repeated after
30 washing.

EXAMPLE 2

An application stick is made from the following ingredients:

		<u>PARTS BY WEIGHT</u>
05	Eutanol G ¹	39.0
	Comperlan HS ¹	11.0
	Stearic acid	10.0
	HEPPS	5.0
	Ethanol 96% v/v	20.0
10	Glycerol	15.0

¹Henkel International, Federal Republic of Germany.

The ingredients other than ethanol are mixed and melted together. The temperature of the melt is brought below 70°C, whereupon the ethanol is added and well mixed in.

15 The melt is poured into suitable moulds and allowed to set. The resulting moulded sticks are removed from the moulds, wrapped individually in aluminium foil and packed.

A stick is rubbed gently on to an area of skin showing psoriatic symptoms. These sticks may conveniently be

20 carried in a patient's pocket or handbag.

EXAMPLE 3

An ointment is made from the following ingredients:

		<u>PARTS BY WEIGHT</u>
	Liquid paraffin	11.0
25	Petroleum jelly	30.0
	Paraffin wax	6.0
	Glycerol	38.0
	Polyoxyethylene homogeniser	10.0
	HEPPS	5.0

05 The ingredients other than glycerol are melted together. The temperature of the melt is brought below 70°C whereupon the glycerol is added with good stirring. the ointment is cooled to room temperature with further agitation, and when cool is passed once through a conventional ointment mill. This ointment is suitable for treating larger areas of skin, or where the cosmetic effect of treatment is deemed unimportant.

Examples 4 and 5

10 These are creams of the vanishing type. They are made up from the following sets of ingredients:

		<u>PARTS BY WEIGHT</u>	
		<u>Example 4</u>	<u>Example 5</u>
<u>A. OIL PHASE</u>			
15	Stearic acid	10.0	10.0
	Beeswax	2.0	2.0
	Paraffin wax	12.0	10.9
	Polyoxyethylene sorbitan monolaurate ¹	10.9	10.0
	Glycerol monostearate (acid stable grade)	5.0	5.0
20	D.C. Silicone fluid 200/350 (Dimethyl siloxane)	---	2.5
<u>B. AQUEOUS PHASE</u>			
25	HEPES	1.0	1.0
	Sorbitol	10.0	---
	Magnesium sulphate	0.1	0.1
	Water (q.s. ad 100)	49.0	58.5
TOTAL		100.0	100.0

30 ¹ Commercially available under the trade name TWEEN 20.

05 The ingredients of B are made into a solution, brought to 90°C-95°C, and added with stirring to the melted and mixed ingredients of A at about 80°C. Stirring is continued until the temperature falls below 35°C or until the cream has set.

These creams are packed and used as described in Example 1.

Examples 6 and 7

10 These vanishing creams contain as active ingredients at least one of the biological buffers described by Good, N. et al, Biochemistry 1966, 5, 467. Of the zwitterionic
15 buffer substances therein described, the ones here used have been found particularly suitable. Their names, as previously indicated, are herein abbreviated for convenience to MES and PIPES. The creams are made up from the following ingredients:

		<u>PARTS BY WEIGHT</u>	
A. <u>OIL PHASE</u>		<u>Example 6</u>	<u>Example 7</u>
20	Stearic acid	10.5	10.5
	Sunflower oil	3.5	3.5
	Silicone fluid	4.0	4.0
	Glycerol monostearate	5.0	5.0
	Paraffin soft white	2.0	2.0
	Tween 20 (see Ex.8-9)	10.0	10.0

B. AQUEOUS PHASE

	MES	4.0	----
	PIPES	----	0.1
05	Water (q.s. ad 100)	61.0	64.9
	TOTAL	<u>100.0</u>	<u>100.0</u>

10 The B ingredients are made into a solution and brought to 90°C-92°C, then added with stirring to a melt of the A ingredients made at 95°C-100°C and cooled to 90°C. Stirring is continued until the cream has set (below 35°C).

The creams are packed and used as described in Example 1. They can be removed from the hands by a simple soap and water wash, like the products of all the examples.

EXAMPLE 8

15 This example illustrates a typical formulation which can be used for the pharmaceutical presentation of any of the zwitterionic substances (ZASA's) the newly discovered medical properties of which are disclosed in the present specification.

20	<u>INGREDIENT</u>	<u>PARTS BY WEIGHT</u>
	Stearic acid	10.0
	Vegetable oil (e.g. Sunflower)	9.0
	Glyceryl monostearate (self-emulsifying)	2.5
25	Silicone oil (200-350 centistokes)	0.5
	TWEEN 20 (Polyoxyethylene sorbitan monolaurate)	8.0
	The selected ZASA	0.1 to 1.0
	Water (q.s. ad 100)	69.9 to 69.0

The ingredients are put together by known pharmaceutical procedures, such as those set out in the previous examples.

05 In addition to preservatives, other conventional pharmaceutically acceptable additives may be incorporated in the compositions of the invention. These include, for example, humectants, film formers and water repellents. Sorbitol is a useful humectant. A 4% mucilage of Methyl cellulose is a useful film former. The dimethyl silicones
10 under the trade designations F 110 and F 111, are useful water repellents.

The ZASA's herein prescribed, when used in proportions in the range 0.1 to 1.0% by weight of a pharmaceutical composition of the invention, are mild and cause no skin
15 irritation. When applied regularly over a period of weeks to clean dry skin initially showing psoriatic symptoms, they have been shown firstly to ease the cracked, dry skin which is typical of the psoriatic condition, secondly to ease the concomitant irritation, and finally to arrest the
20 pathological condition in a relatively rapid manner, permitting the skin to return to a normal, healthy-looking state free from redness, scale, chapping and cracking. The period involved is usually two to four weeks.

EXAMPLE 9

25 Therapeutic effect.

The effect was first observed by chance in a factory environment wherein compositions of the present invention were in use for a non-medical purpose (see European application No. 82 110 658.0). The tests of the present example
30 were then organized ad hoc.

Eight volunteer adult sufferers from mild to moderate plaque-type psoriasis were selected for treatment during respective active episodes of the ailment. Five were males, three females; their ages ranged from 16 to 50. At least five of them had had prior professional diagnosis by a family physician. None was receiving intensive topical or systemic treatment at the time of the investigation. The body areas affected varied from one volunteer to another, but included the hands, forearms, elbows, face and, in one case, the scalp.

Each volunteer was provided with a quantity of the product of Example 8 containing, as active ingredient, HEPES in a proportion of 0.3% by weight, and was instructed to apply it to the affected areas of skin twice a day after washing. The instructions were carried out by all the volunteers.

Seven volunteers reported subjective improvement after periods varying from 7 to 14 days, and this was confirmed in all seven cases by lay observation, and in two cases by the family physician. One volunteer reported no noticeable change in symptoms for the better or the worse.

Four of the volunteers (2 male, 2 female) subsequently discontinued the treatment. All four reported a recurrence of symptoms after about 7 days. This was also confirmed by lay observation.

The remaining three volunteers have persisted with the treatment and have had no recurrence of symptoms with the last six months.

Several other workers in the same establishment, with no symptoms or history of inflammatory skin disease, applied the same product to their hands twice a day for an extended period (over two months), using it as a protective cream against accidental tissue adhesion by cyanoacrylate-type

adhesives. None of these reported any deleterious effect, on the skin or otherwise. These results are preliminary and incomplete.

05 The same product was tested at the Biological Laboratories, Ballina, Co. Mayo, Ireland and found not to be a skin irritant.

Preliminary testing on animals is under way, in which a 1% Hydrocortisone cream is being used as a comparison, but the results are not yet to hand.

10 Application has been made, on the basis of these -- preliminary results, to the National Drugs Advisory Board of Ireland for approval for the setting up of systematic clinical tests.

15 Meanwhile the pharmacology of the ZASA's is under investigation in the Department of Clinical Medicine, Trinity College, Dublin.

20 While the number of sufferers treated to date with compositions of the invention is small, all of them have reported the relatively rapid improvement mentioned above. The face, hands, arms and elbows have all exhibited the kind of recovery described.

25 Although we do not wish to be bound by the terms of any theory, we suspect that pH control of the skin, coupled with the use of an aminosulfonic acid, is one factor in producing the effects we have seen. A major factor appears to be the recently discovered fact that the active ingredients of the compositions are effective in suppressing the functioning of neutrophils, a variety of white blood corpuscle. There is prior evidence to suggest
30 that neutrophils, which are known to infiltrate into psoriatic lesions, are at least partly responsible for th

- damage to epidermal cell membranes which is characteristic of psoriasis. The evidence is summarised and amplified in two papers by M M Young and F J Bloomfield: 1) Influence of lithium and fluoride on degranulation from human
- 05 neutrophils in vitro: Inflammation, Vol. 6, No. 3, 1982, pp. 257-267.
- 2) Enhanced release of inflammatory mediators from lithium-stimulated neutrophils in psoriasis: British Journal of Dermatology (1983) 108, Paper 607/6288.
- 10 The content of these papers is incorporated in the present description by reference. One of the authors (Bloomfield) is responsible for the discovery of neutrophil function suppression by ZASA's; the work is unpublished.

CLAIMS

- 05 1. A pharmaceutical composition for treating psoriasis and related conditions which comprises at least one skin-compatible zwitterionic aminosulfonic acid (one ZASA) having the formula
- $$\text{RNR}'\text{SO}_3\text{H}$$
- 10 wherein either R is a C₁₋₆ straight or branched chain aliphatic radical or the combination RN is a substituted or unsubstituted nitrogen-containing heterocyclic radical which may have one hetero-atom additional to the nitrogen atom that links said radical to R'; and R' is a C₂₋₄ straight or branched chain alkylene radical, together with a pharmaceutically acceptable topical carrier or base.
- 15 2. A composition as claimed in claim 1 wherein the ZASA has at least one pK_a value at 20°C in the range 6.0-8.3.
3. A composition as claimed in claim 1 wherein R represents tris-(hydroxymethyl)-methyl.
- 20 4. A composition as claimed in claim 1 wherein RN represents a radical selected from the group consisting of N-piperaziny, N-morpholinyl and N-[N'-(2-hydroxy-ethyl)]-piperaziny.

5. A composition as claimed in claim 1 wherein R' is selected from the group consisting of $-\text{CH}_2-\text{CH}_2-$ and $-\text{CH}_2-\text{CH}_2-$.
- 05 6. A composition as claimed in claim 1 wherein the ZASA is selected from the group consisting of
2-(N-Morpholinyl)-ethane sulfonic acid (MES),
2-[N-[N'-(2-Hydroxyethyl)]-piperazinyl]-ethane sulfonic acid (HEPES),
10 3-[N-[N'-(2-Hydroxyethyl)]-piperazinyl]-propane sulfonic acid (HEPPS),
2-[N-[tris-(Hydroxymethyl)]-methylamino]-ethane sulfonic acid,
2-(N-Piperazinyl)-ethane sulfonic acid,
2-(N-Piperazinyl)-propane sulfonic acid,
15 Piperazine-1,4-bis(2-ethane sulfonic acid) (PIPES) and
N,N-bis-(2-Hydroxyethyl)-2-aminoethane sulfonic acid (BES).
7. A pharmaceutical composition as claimed in any of claims 1 to 6 wherein the proportion of ZASA is in the range 0.05 to 20% by weight of the composition.
- 20 8. A pharmaceutical composition as claimed in claim 7 wherein the proportion is in the range 0.05 to 5%.
9. A pharmaceutical composition as claimed in claim 8 wherein the proportion is in the range 0.1 to 1.0%.
- 25 10. A skin-compatible zwitterionic aminosulfonic acid (ZASA), as defined in claim 1, for use in the topical treatment of psoriasis and related skin disorders.
11. A compound as set out in claim 6 for use in the topical treatment of psoriasis and related skin disorders.



European Patent
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EUROPEAN SEARCH REPORT

0100827

Application number

EP 83 10 5025

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	CHEMICAL ABSTRACTS, vol. 88, no. 13, 27th March 1978, page 208, no. 85619y, Columbus, Ohio, US YAIR AHARONOWITZ et al.: "Influence of inorganic phosphate and organic buffers on cephalosporin production by Streptomyces clavuligerus" & ARCH. MICROBIOL. 1977, 115(2), 169-73 * Abstract *	1-11	A 61 K 31/255 A 61 K 31/50 A 61 K 31/535// C 07 C 143/14 C 07 D 295/08
X	--- CHEMICAL ABSTRACTS, vol. 92, no. 9, 3rd March 1980, page 334, no. 72564j, Columbus, Ohio, US T.K. KIM et al.: "Chemical and electron microscopic studies of factors associated with the release of penicillinase from Staphylococcus aureus" & ANTONIE VAN LEEUWENHOEK 1979, 45(4), 581-93 * Abstract *	1-11	
X	--- CHEMICAL ABSTRACTS, vol. 93, no. 13, 29th September 1980, page 125, no. 126343c, Columbus, Ohio, US B.M. ALTURA et al.: "Adverse effects of artificial buffers on contractile responses of arterial and venous smooth muscle" & J. PHARMACOL. 1980, 69(2), 207-14 * Abstract *	1-11	A 61 K 31/00 C 07 C 143/00 C 07 D 295/00
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22-11-1983	Examiner MOREAU J.M.
CATEGORY OF CITED DOCUMENTS			
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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	CHEMICAL ABSTRACTS, vol. 94, no. 17, 27th April 1981, page 126, no. 132797r, Columbus, Ohio, US G. TUNNICLIFF et al.: "Competitive inhibition of gamma-aminobutyric acid receptor binding by N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid and related buffers" & J. NEUROCHEM. 1981, 36(3), 1122-6 * Abstract *	1-11	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
Place of search THE HAGUE		Date of completion of the search 22-11-1983	Examiner MOREAU J.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory r principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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